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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/692,470	10/20/2000	Shinji Yamamoto		6675

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FOLEY AND LARDNER  
SUITE 500  
3000 K STREET NW  
WASHINGTON, DC 20007

EXAMINER

NGUYEN, TU MINH

ART UNIT PAPER NUMBER

3748

DATE MAILED: 01/29/2004

23

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.  
09/692,470

Applicant(s)  
Yamamoto et al.

Examiner  
Tu M. Nguyen

Art Unit  
3748



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on Nov 10, 2003
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1, 2, 5-10, and 12-36 is/are pending in the application.
- 4a) Of the above, claim(s) 7-10 and 12-14 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 19-22 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 6, 17, 18, 23-33, 35, and 36 is/are rejected.
- 7) ☒ Claim(s) 5, 15, 16, and 34 is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on Jan 3, 2002 is: a) ☒ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some\* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). \_\_\_\_\_ 6) ☐ Other:

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### **DETAILED ACTION**

1. An Applicant's Applicant's Amendment filed on November 10, 2003 has been entered. Claims 1, 17, 23, 28-30, 33, and 35 have been amended. Overall, claims 1, 2, 5-10, and 12-36 are pending in this application.
2. In the response to the restriction requirement mailed on January 11, 2002, applicant elected on May 31, 2002 (Paper No. 10) the species of Figure 2 without traverse. Claims 5, 6, 15-23, and 31-36 are readable on the species of Figure 2. Claims 1, 2, and 24-30 are generic. Thus, claims 1, 2, 5, 6, and 15-36 will be examined in its full merit. Claims 7-10 and 12-14 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

### ***Drawings***

3. The amended drawings filed on January 3, 2002 have been approved for entry. Formal drawings with the approved changes are required in reply to this Office Action.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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5. Claims 1, 2, 18, 23-30, 32, 33, 35, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Twigg (PCT Publication No. WO 00/53903).

Re claims 1, 28-30, 33, and 35, as shown in Figure 1, Twigg discloses an exhaust gas purifying system and an exhaust gas purifying method of a multiple step control type in combination with an internal combustion engine (1) having an exhaust gas passageway (2), the engine includes a combustion system having a combustion control device (9) for controlling at least one selected from the group consisting of operating parameters of the engine and combinations of the operating parameters, the operating parameters including fuel injection timing, spark timing, opening and closing timings of intake and exhaust valves of the engine. The exhaust gas purifying system includes:

- a NOx treating catalyst (11) for reducing NOx disposed in the exhaust gas passageway to reduce NOx in presence of reducing components in exhaust gas, and

- a hydrogen enriching device (5) disposed upstream of the NOx treating catalyst with respect to flow of exhaust gas and including a device (5) arranged to increase a ratio of hydrogen to total reducing components in the exhaust gas,

wherein the hydrogen enriching device is a device (5) for producing hydrogen from a shift reaction between CO and water in the exhaust gas, the device (5) is a hydrogen producing catalyst containing at least a hydrogen producing catalyst containing at least one noble metal (lines 18-26 of page 3); and

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wherein both the NO<sub>x</sub> treating catalyst (11) and the hydrogen enriching device (5) are disposed in the exhaust passageway (2); and the combustion control device (9) controls the exhaust gas flowing into the hydrogen producing catalyst (5).

Twigg, however, fails to specifically disclose that the hydrogen enriching device (5) is arranged to increase a ratio of hydrogen to total reducing components in the exhaust gas so as to relations represented by the following formulae (1) and (2), when reduction of NO<sub>x</sub> is carried out by the NO<sub>x</sub> treating catalyst:

$$[H_2 / TR]_d > [H_2 / TR]_u \quad (1)$$

$$[H_2 / TR]_d \geq 0.3 \quad (2)$$

where  $[H_2 / TR]_u$  is a ratio between a concentration  $[H_2]_u$  of hydrogen and a concentration  $[TR]_u$  of total reducing components in exhaust gas in the exhaust gas passageway upstream of the hydrogen enriching device; and  $[H_2 / TR]_d$  is a ratio between a concentration  $[H_2]_d$  of hydrogen and a concentration  $[TR]_d$  of total reducing components in exhaust gas in the exhaust gas passageway upstream of the NO<sub>x</sub> treating catalyst and downstream of the hydrogen enriching device.

In the above formula (1),  $[H_2 / TR]_u$  is approximately zero as only a trace amount of hydrogen is produced from the combustion engine.  $[H_2 / TR]_d$  is equal to the ratio of  $\{[H_2]_u + [H_2]\}$  and  $\{[TR]_u + [TR]\}$ , where  $[H_2]$  and  $[TR]$  are the concentration of hydrogen and total reducing components produced by the hydrogen enrichment device, respectively. Per molar basis,  $[H_2]_u$  is approximately zero; and with the water shift reaction shown on line 2 of page 7,

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[H<sub>2</sub>] and [TR] are both equal to 1. Therefore, [H<sub>2</sub> / TR]<sub>d</sub> is equal to  $1/\{1+[TR]_u\}$  which is clearly greater than zero. Thus, formula (1) is obviously satisfied when the hydrogen enrichment device is active to produce a mixture containing hydrogen in accordance to the water shift reaction shown on page 7. In formula (2), as shown earlier,  $[H_2 / TR]_d = 1/\{1+[TR]_u\}$  and is greater than or equal to 0.3 only if [TR]<sub>u</sub> is less than 2.33 mole. It is hereby argued that [TR]<sub>u</sub> is approximately equal to 1 (one mole of CO) as the exhaust gas exiting the engine contains CO and negligible amount of unburned HC. Hence, formula (2) is obviously satisfied when the hydrogen enrichment device is active and producing a mixture containing hydrogen in accordance to the water shift reaction shown on page 7.

Re claims 2 and 36, in the system of Twigg, the hydrogen enriching device is arranged to increase a ratio of hydrogen to carbon monoxide in the total reducing components in exhaust gas so as to meet a relation represented by the following formula  $[H_2 / CO]_d > 1$  where  $[H_2 / CO]_d$  is a ratio between a concentration [H<sub>2</sub>]<sub>d</sub> of hydrogen and a concentration [CO]<sub>d</sub> of carbon monoxide in the total reducing components in exhaust gas in the exhaust gas passageway immediately upstream of the NO<sub>x</sub> treating catalyst and downstream of the hydrogen enriching device, when reduction of NO<sub>x</sub> is carried out by the NO<sub>x</sub> treating catalyst (at a location downstream of the hydrogen enrich device (5), per molar basis, the concentration of CO is approximately zero and the concentration of hydrogen is 1 (see water shift reaction on line 2 of page 7). Thus, the above formula is clearly satisfied).

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Re claim 18, in the system of Twigg, the hydrogen producing catalyst (5) has a function to produce hydrogen from HC and CO in the exhaust gas.

Re claim 23, the system of Twigg further comprises a device (9) for controlling exhaust gas at a position upstream of the hydrogen producing catalyst to intermittently have a composition in which air-fuel ratio is rich, so as to raise efficiency of production of hydrogen by the hydrogen producing catalyst (lines 18-19 of page 3).

Re claim 24, the NOx treating catalyst of Twigg contains one of more noble metal selected from the group consisting platinum, palladium, and rhodium; and at least one substance selected from the group consisting of alumina (ceramic), alkali metal and alkaline earth metal (lines 1-6 of page 5).

Re claim 25, in the system of Twigg, the NOx treating catalyst contains at least rhodium and arranged to be adapted for reducing NOx in exhaust gas at a temperature ranging from 260 to 380°C.

Re claim 26, the combustion device in the system of Twigg is an internal combustion engine (1).

Re claim 27, the internal combustion engine in the system of Twigg is a gasoline-fueled engine for an automotive vehicle.

Re claim 32, in the system of Twigg, the hydrogen enriching device is a device (5) for decreasing the reducing components (CO) other than hydrogen in the exhaust gas.

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6. Claims 6, 17 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Twigg as applied to claims 1 and 30, respectively, above, in view of Kobayashi et al. (U.S. Patent 5,124,303) and Tauster et al. (U.S. Patent 4,149,998).

Re claims 6 and 31, the system of Twigg discloses the invention as cited above, however, fails to disclose that the hydrogen enrichment device is a device for suppressing consumption of hydrogen in at least one of combustion gas and exhaust gas; and that the device is a catalyst containing solid acidic zirconium oxide.

Kobayashi et al. teach a catalyst for treatment of waste gas, that contains solid acidic zirconium oxide. Tauster et al. teach that catalysts that contain an oxide of zirconium is known to suppress the chemisorption of hydrogen (see the Abstract). Therefore, the catalyst in Kobayashi et al. can suppress the consumption of hydrogen in the exhaust gas. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the catalyst taught by Kobayashi et al. in the system of Twigg, since the use thereof would have provided an effective system to remove harmful emissions in the exhaust gas of internal combustion engines.

Re claim 17, in the modified system of Twigg, the catalyst containing solid acidic zirconium oxide contains platinum, the solid acidic zirconium oxide containing at least one element selected from the group consisting of titanium, aluminum tungsten, molybdenum and zinc, the solid acidic zirconium oxide having a composition represented by the following general formula (4):



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where Y is at least one element selected from the group consisting of titanium, aluminum, tungsten, molybdenum and zinc; d and e are ratios of atoms of elements; and f is a number of oxygen atoms required for satisfying valences of Y and Zr, in which d is within a range of from 0.01 to 0.5, e is within a range of from 0.5 to 0.99, and  $d+e = 1.0$  (see Example 3 in Kobayashi et al.).

#### *Allowable Subject Matter*

7. Claims 19-22 are allowed.

Claim 5, 15, 16, and 34 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

#### *Response to Arguments*

8. Applicant's arguments with respect to the references applied in the previous Office Action have been considered but are moot in view of the new ground(s) of rejection.

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*Conclusion*

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

*Prior Art*

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure and consists of one patent: Twigg (U.S. Patent 6,651,424) is the U.S. patent equivalent to the PCT Pub. No. WO 00/53903 document.

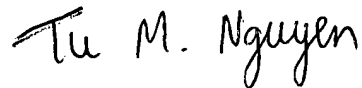
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*Communication*

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (703) 308-2833.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (703) 308-2623. The fax phone number for this group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-1148.



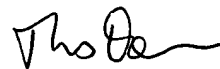
TMN

Tu M. Nguyen

January 24, 2004

Patent Examiner

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THOMAS DENION  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 3700